3.8 Fisheries

Executive Summary for the Effects of the Project on Fisheries

This project would have very little effect, positive or negative, on fish or aquatic habitats. Potentially, there are small beneficial effects, and low risk of minor negative impacts. Beneficial effects would be localized, but have the potential for long term effects. In all action alternatives, erosion near the borrow pit and the road that accesses it would be reduced, and the replacement of the fish-bearing culvert in Lick Creek at Rd 10051 would be placed on the prioritized list of fisheries projects. Alternative 4 also includes restoring deciduous riparian vegetation. There is very little risk of the project creating deleterious effects to fish and aquatic habitat that would reach the level of being measureable. Negative effects that could occur would likely be a result of erosion from roads and road use.

Introduction

This is an analysis of the effects of the proposed Como Forest Health Project, and the alternatives, on native fishes and other aquatic species and the aquatic environment that they rely upon. The Como Forest Health Project area is located within the Bitterroot River subbasin which consists of several subwatersheds including the three affected by the proposed project: South Lost Horse Creek, Lick Creek, and Rock Creek.

Included in this report is the information required for a biological evaluation of aquatic species that are listed as sensitive by the Regional Forester. These species include westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) and western pearlshell mussel (*Margaritifera falcata*). A biological assessment (BA) will address the effects of the project's preferred alternative on bull trout (*Salvelinus confluentus*), a species federally listed as threatened. The BA is a separate document to be reviewed by the U.S. Fish and Wildlife Service (USFWS) prior to the signing of a Record of Decision. The preliminary determinations and substantive summaries from the draft BA are provided in this document.

3.8.1 Overview of Issues Addressed

The indicators used to assess effects on aquatic species and their habitats focus on roads because roads have been observed in the field and described in the literature as a key component in the degradation of aquatic habitat on the National Forests in western Montana. Specifically the primary issues are:

- The proximity of existing roads to streams and the amount of log hauling along roads near streams,
- The proximity of potential disturbance, chiefly harvest-related activities and road building, to streams or intermittent channels.

These issues are assessed in context with the occurrence and distribution of threatened, endangered or sensitive (TES) species.

Good quality native fish habitat is: cold, clean, connected, and complex. These attributes have been dubbed the 4 Cs of native fish habitat (Montana DNRC 2005). The 4 Cs of native

trout habitat provide a solid basis for evaluating the effects of projects on native fish. The 4 C s are further defined in the following ways:

- Native fish need cold water. Projects that affect the amount of shade along streams or the amount of water in streams can affect native fish.
- Native fish require clean waters and substrates, particularly for rearing and spawning.
- Habitat that is connected at multiple scales (ranging from very small streams to large rivers) is important to allow distribution of populations and access to habitats for various life stages.
- Habitat complexity provides space for many aquatic species and their life stages. In this project area habitat complexity is related to the amount of large wood that accumulates in channels and floodplains. Habitat complexity in this area is also related to maintaining the natural variability in channel types and floodplains. Floodplains in this project area are generally very narrow and confined, but there are also a few broad and flat drainage-bottoms along Lick Creek.

In addition to the 4 Cs that address physical characteristics there are other factors that influence the aquatic species. These include interactions with non-native species like brook trout, risks related to invasive species such as invasive aquatic plants or invertebrates, and the cumulative effects of physical and biological factors.

3.8.1.1 Issue Indicators

Below is a list of potential issues raised during scoping that relate to the proposed project. Each issue includes a statement explaining how the effects are measured.

Issue: Increased water temperatures resulting from reduced shade near streams.

- Influence is measured by:
  - Change in shading along streams with native fish habitat or along streams that contribute to those habitats.
  - Change in areas with the potential to grow vegetation that could provide shade and cool streams containing native trout habitat.

Issue: Decrease in habitat complexity resulting from the reduction of current or future amounts of large wood near streams.

- Influence is measured by:
  - Change in the amount of large trees along streams and floodplains, or the future recruitment of large trees. These large trees eventually contribute to aquatic habitat complexity.

Issue: Barriers in streams affect natural movement and life history characteristics of fish and other aquatic species.

- Influence is measured by:
  - Change in stream length unaffected by man-made barriers.

Issue: Accelerated deposition of sediment into streams and wetlands.

- Influence is measured by:
  - Change in the erodability, size and proximity of existing roads to aquatic habitats, including all streams and wetlands.
  - The size and proximity of new roads relative to aquatic habitats.

Issue: Effect on native fish population characteristics such as growth and survival, genetic integrity, and predation and competition.

- Influence is measured by:
  - Qualitative estimates of the populations' ability to recover from disturbances (for example: fire) and probability of increased hybridization or displacement by competitive species (USFWS 1998b).

Issue: Changes to habitats related to stream form and function,

- Influence is measured by:
  - Models that predict the effects to physical characteristics of the area's streams are explained in detail in the Watershed section (Section 3.7.4.1 contains the methodology, and Section 3.7.4.8 reports the results).

3.8.2 Overview of Relevant Laws, Regulations, and Policies

The Bitterroot National Forest Plan

The Bitterroot National Forest Plan (USDA Forest Service 1987) provides direction to protect and manage fish and aquatic resources. The Inland Fish Strategy (INFISH, USDA Forest Service 1995) amended the Forest Plan and added detail in the form of standards and guidelines. The Forest Plan forest-wide goal for fisheries is to provide habitat to support viable populations of native and desirable non-native fish, maintain habitat for the possible recovery of threatened and endangered species, and maintain riparian flora, fauna, and water quality (USDA Forest Service, 1987: II-3). The 1987 Bitterroot Forest Plan designates the westslope cutthroat trout as the management indicator species for assessing management's impact on the fishery (II-20).

Management Area 3b includes streamside riparian habitats on the Forest. This management area is generally a corridor surrounded by other management areas. The Management Area 3b goal is to maintain flora, fauna, water quality, and water-related recreation activities, and emphasize water and soil protection. The Forest Plan considers a low to moderate level of timber harvest appropriate in riparian areas. Roads in riparian areas will be restricted to meet water quality and fish objectives (USDA Forest Service, 1987: III-22).

Forest Plan management standards related to fisheries and this project are (USDA Forest Service, 1987: III-23 through 25):

- Existing recreation facilities will be managed to protect riparian areas.
- Timber management in riparian areas will meet fisheries and water quality objectives.
- Stream channels and fish habitat will be maintained.

- Fish habitat improvement projects will be scheduled to improve fisheries.

INFISH (USDA 1995) refines Forest Plan standards with seven pages of standards and guidelines (pages A-7 to A-13). The standard most relevant to this project is TM-1(b), which calls for the use of silvicultural practices in Riparian Habitat Conservation Areas (RHCAs) to acquire desired vegetation characteristics where needed to attain Riparian Management Objectives (RMOs), and to apply silvicultural practices in a manner that does not retard attainment of RMOs and that avoids adverse effects on native fish. Road management standards in INFISH relevant to this project include guidance to meet the RMOs and avoid adverse effects to native fish by:

- Addressing issues related to the road infrastructure. This includes developing and implementing road management plans, minimizing roads and landings in RHCAs.
- Regulating traffic during wet periods to minimize erosion and sediment delivery.
- Maintaining roads to avoid sediment delivery to streams, and to provide passage at stream crossings for aquatic species.

Endangered Species Act (ESA)

Bull trout and their Critical Habitat will be addressed in a biological assessment that will be completed prior to the decision being signed for this project.

Montana Stream Protection Act [SPA] and Stream Management Zone [SMZ] Law and Rules.

These rules protect and maintain the functions of a stream channel and SMZ, respectively. All activities falling within the jurisdiction of the SPA will be permitted as required by the state. The SMZs are generally smaller and less restrictive then the RHCAs defined in INFISH (USDA Forest Service 1995).

Other Guidance

- Westslope Cutthroat Trout Conservation Agreement (Montana Fish, Wildlife and Parks 2007)
- Western Montana Bull Trout Conservation Strategy, Bitterroot National Forest section (USDA Forest Service 2013)
- Sensitive species guidelines: Westslope cutthroat trout and western pearlshell mussel are Bitterroot National Forest sensitive species. Information necessary for the biological evaluation of sensitive species has been incorporated into this fisheries and aquatic habitat effects analysis and is summarized in the Regulatory Consistency section below.

3.8.3 Existing Condition of the Affected Environment

Generally, native fish in the analysis area (Figure 3.8-4) are struggling to persist. The most influential factors that influence the aquatic species and habitats in the analysis area are:

- Competition, predation, and hybridization with non-native brook and rainbow trout
- Dewatering of Lost Horse and Rock creeks

- Transfer of water and non-native brook trout from Lost Horse Creek into Lick Creek during the Bitter Root Irrigation District's (BRID) Lost Horse Feeder Canal siphon cleanout.
- Partial barrier to fish movement at the BRID Lost Horse Feeder Canal diversion dam in Lost Horse Creek, Lake Como dam (complete barrier to upstream movement) and at Lick Creek at the BRID road crossing (partial barrier).
- Erosion and sediment from historical near-stream roads and railway prisms
- Erosion and sediment from the existing open road system
- Cattle bank trampling along lower Lick Creek
- Dispersed recreation and firewood collection, especially along Lost Horse Creek
- Fluctuations in water volume and temperature in upper Lost Horse Creek as a result of water management in Twin Lakes (headwater reservoir), and in Rock Creek from Lake Como
- Possible native cutthroat hybridization with non-native fish spilling from headwater lakes. Lost Horse Lake is suspected of containing Yellowstone cutthroat trout; Fish Lake contains reproducing rainbow trout (Brassfield, et al. 2008 & draft 2014).
- In the summer, the mainstem Bitterroot River as well as the lower reaches of many tributaries are unsuitably warm for native trout.

When multiple threats are present, it is often difficult to determine which threats have the greatest negative influence. This complicates effective conservation and restoration of native species and their habitats. Larger scale plans, such as the Bull Trout Conservation Strategy (USDA Forest Service 2013) assist in making informed decisions regarding conservation of native fish in western Montana. The Strategy outlines habitat restoration activities that contribute to the goals of native trout habitat restoration and population recovery. It is also recognized that conservation and restoration of aquatic habitats contribute to the overall health of ecological systems in and beyond this analysis area.

The Bull Trout Conservation Strategy (USDA Forest Service 2013) identifies threats that are significant to local populations in western Montana; providing an outline for the Forest Service to pursue. The Bull Trout Conservation Strategy emphasized the Lost Horse subwatershed, but not Rock or Lick subwatersheds. The strategy suggests that the key limiting factor in Lost Horse Creek is the lack of connectivity to the rest of core area (Bitterroot River) with non-native brook trout being the secondary factor. It also suggests that there are barriers to fish movement, that large wood could be lacking in some reaches as a result of the near-stream road and that placement of large wood might be a short-term improvement in the parts of the stream that are lower gradient.

A weakness of the Bull Trout Conservation Strategy is its focus on Forest Service lands. The Strategy irregularly accounts for influences of the private lands on the species, and the values that would be gained by including all lands in a restoration plan. For example, lower Lost Horse Creek, downstream of the Forest boundary, is dewatered for much of the summer (Bahn 2007). On a positive note, a substantial seasonal barrier (a ditch crossing)

near the mouth of Lost Horse Creek on private lands has been removed and will improve the connection between the river and the headwaters of Lost Horse Creek.

Bull trout are currently absent in the Lick Creek and Rock Creek drainages, common in a mid-elevation reach of Lost Horse Creek, and rare in lower Lost Horse Creek (MTFWP 2012; Bahn 2007). Fluvial native trout, bull trout and cutthroat trout, still migrate from the Bitterroot River to spawn in some Bitterroot tributaries. A decline in the valuable large-bodied migratory form of both native trout species decreases the viability of the remaining resident life forms.

The migratory native trout are far below their historical levels in the Lost Horse Creek drainage (Bahn 2007, USDA Forest Service 2013), and are presumed to be rare in Lost Horse and Lick creeks, and lower Rock Creek . They are blocked from upper Rock Creek by the Lake Como dam. Potential reasons for low numbers of migratory native trout include:

- High water temperatures in summer that may form thermal barriers or mortality in all 3 of the primary fish-bearing streams in the analysis area
- High levels of sediment in the substrates of Lick Creek
- Predominance of non-native brook trout in lower reaches Lick and Lost Horse Creeks (Figure 3.8- 1)
- Barriers to fish movement at Lake Como (Rock Creek) and Bitterroot Irrigation Diversion (Lost Horse Creek) dams
- Nearly complete stream dewatering in lower Rock and Lost Horse creeks, and
- Anchor ice that forms along the channel bottom sealing-off winter habitat. Streams most susceptible to this are wide, shallow, and lack a forest canopy.

Westslope cutthroat trout are common and viable in Lick, Lost Horse, and upper Rock creeks, but less common in lower Rock Creek during the heat of the summer. They occupy close to 100% of their historic habitat, with most of those being resident (non-migratory) fish. Most of the westslope cutthroat trout are small (2-10 inches) and are believed to number between the hundreds to low thousands. Genetic testing of westslope cutthroat trout purity

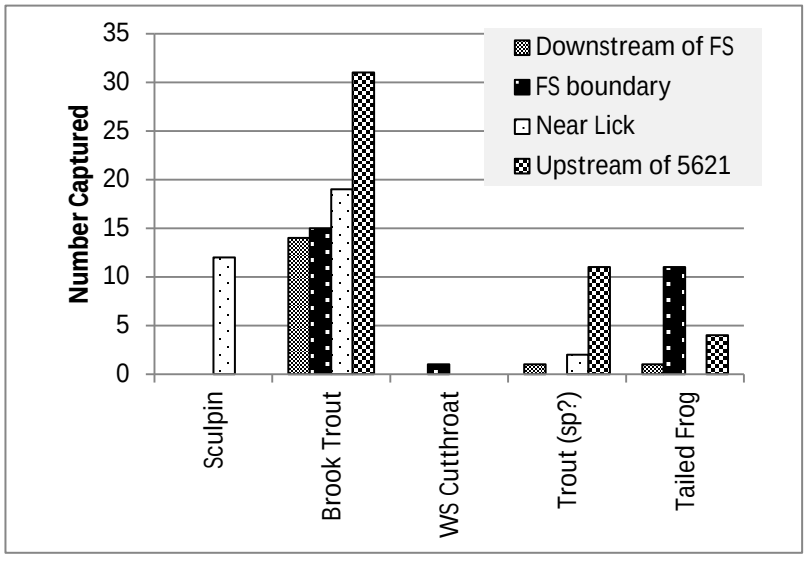

Figure 3.8- 1: Aquatic Species Captured in 4 Sections of Lick Creek in 2013. "Trout (sp?)" represent trout species that were not clearly identifiable. Bars for each species are in a downstream to upstream order when viewed left to right. Data from M. Lemoine, U of M (2013).

has been limited in the analysis area, but in general, the results suggest that the westslope cutthroat trout population consists of a mix of pure and hybridized (westslope X rainbow) fish. Populations in upper Lost Horse and Lick creeks may be genetically pure. The upper Lost Horse population is influenced by stocking of Twin Lakes in the headwaters.

Densities of stream-resident cutthroat tend to be higher in the headwaters, and lower near the Forest boundary. This is likely to be related to water temperature, other habitat conditions, and competition with non-native fish.

Historically, the headwater lakes of Lost Horse and Rock creeks were likely fishless. The existing condition is that the most accessible lakes are either stocked with cutthroat trout or sterile rainbow trout (triploid) or have self-reproducing non-native fish present.

Brook trout, a non-native competitor, are the most common fish species in Lick Creek. Brook trout inhabit the same areas as the cutthroat trout, which is uncharacteristic for small streams in the Bitterroot drainage. Typically, brook trout are not found as high in the watersheds at cutthroat trout.

Rock Creek is divided by Lake Como and its dam. The creek segment upstream of the dam is isolated from the rest of the Bitterroot River drainage. The dam is a barrier that reduces westslope cutthroat gene flow in the upstream direction (from the river to the headwaters). Rock Creek's headwater lakes have been stocked with cutthroat trout that likely had with origins outside the Bitterroot, and Elk Lake has been reported to have rainbow trout (Kightlinger, et al. 2002). Lower Rock Creek is seasonally dewatered and poorly connected to the Bitterroot River for a substantial portion of the year. Water stored in Lake Como is used for irrigation and to maintain flows in the mainstem of the Bitterroot River.

Surveys conducted in 2013 to locate native Western pearlshell mussels in the project area found no mussels.

As mentioned above, cold water is a key determining factor related to the health and survival of native trout, especially bull trout and, to a lesser degree, westslope cutthroat trout. Figure 3.8- 2 highlights summer temperatures in the project area's two major fish-bearing streams: Lost Horse and Lick creeks. Rock creek below Lake Como is severely dewatered in the summer, has a population of small brook trout, and lacks habitat for maintaining native fish. Rock Creek above the Lake Como reservoir is expected to be at natural temperatures because there are very few anthropogenic effects to upper Rock Creek.

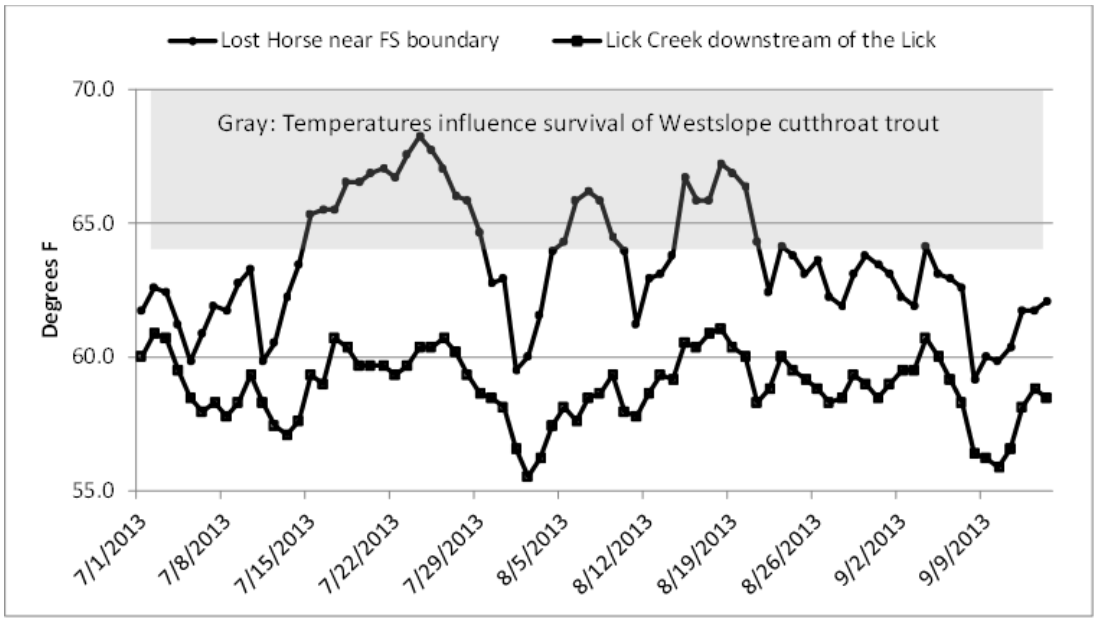

Figure 3.8- 2: Summer Daily High Temperatures in Lost Horse and Lick Creeks in the Project Area in 2013. Data from Bitterroot NF and M. Lemoine, U of M (2013)

Lost Horse Creek summer temperature generally increases in the downstream direction including the area from the Forest boundary to the mouth at the Bitterroot River. Stream temperatures in this private land section were surveyed with digital imagery in thermal infrared in 2004 (MTDEQ 2011). The upper end of this reach was 17.4°C and the temperature downstream was 21.6°C. This was a 4.2°C increase in 5.2 miles. However, the temperature on this section of stream was not constant. Cool side channels and ground water likely create fluctuations in temperature.

Westslope cutthroat trout have been observed to experience stress when temperatures in the upper Bitterroot River approach 64°F. Mortality of the trout is more commonly observed when river temperatures exceed 70°F (C. Clancy, personal communication 2014). The cool temperature of Lick Creek attests to the stream's potential as a native fish restoration project.

Research consistently demonstrates a negative relationship between road density and native trout abundance. Along with overall road density in a watershed, road density near streams is a good indicator of commercial forestry's effect on native trout (Valdal and Quinn 2010).

The overall road density in the fisheries analysis area is low, less than 1 mile per square mile. However, road density is highly variable and roads are concentrated in the Lick Creek area (3.97 miles per square mile).

The proximity of roads to streams is also important. In this regard Lick Creek fares well because there are relatively few roads that closely parallel streams. However, there are many road crossings per mile in Lick Creek (Table 3.8- 2). There 3 road crossings over 6 miles of fish-bearing streams in the project area. Two are bridges that allow unconstrained passage by fish and other aquatic species.

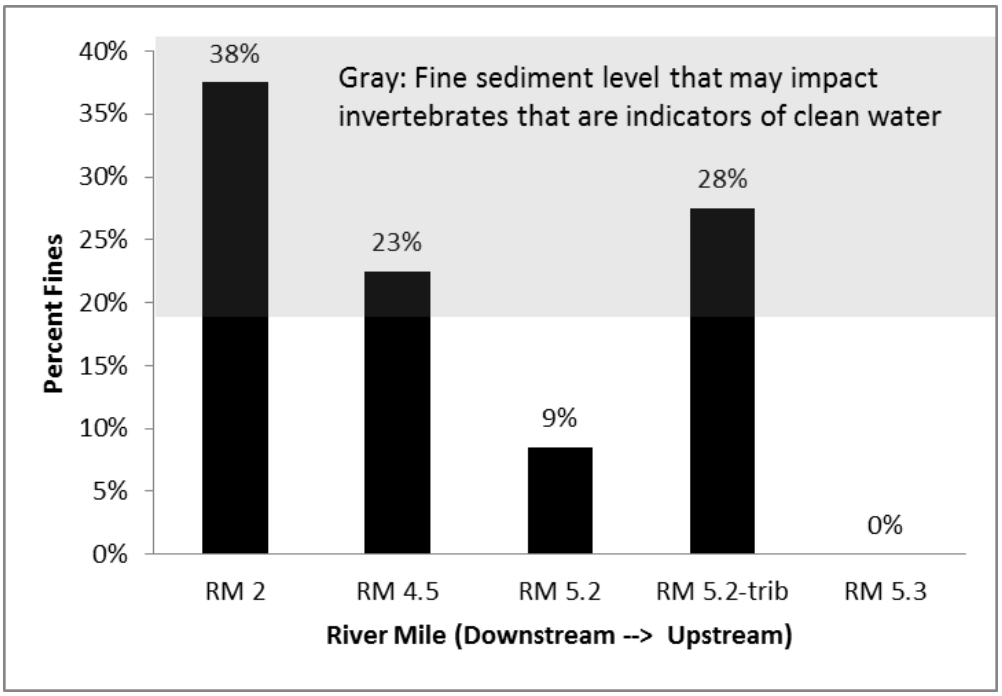

Figure 3.8- 3: Fine Sediments Measured on the Surface of the Lick Creek Streambed in Five Sections.

Fine sediments are a leading cause of impaired biological condition in rivers and streams in the West. Increased sediment loads alter a stream's natural biotic community (algae, macrophytes, invertebrates, and fishes). Turbidity increased by sediments can reduce stream primary production by reducing photosynthesis, physically abrading algae and other plants, and preventing attachment of plants to substrate surfaces. Decreasing primary production can affect many other organisms in the stream food web. Sedimentation has been shown to be a major factor in the habitat loss for mussels. Stream bottom composition is a primary factor influencing aquatic insect abundance and distribution. Aquatic macroinvertebrates are adversely affected by habitat change resulting in increased drift, lowered respiration capacity (by physically blocking gill surfaces or lowering dissolved oxygen concentrations), and reducing the efficiency of certain feeding activities especially filter feeding and visual predation. Macroinvertebrate grazers are particularly affected as their food supply is either buried under sediments or diluted by increased inorganic sediment load thus increasing search time for food. Deposited sediments affect fish directly by smothering eggs in redds, altering spawning habitat, and reducing overwintering habitat for fry, and, indirectly by altering invertebrate species composition, thereby decreasing abundance of preferred prey.

Fine sediment is deposited in streams episodically, often during storm events. Under natural conditions, sediment loading of a channel is characteristic of local geology and climate conditions, and is transported through stream networks. Human activities that increase bank and hillslope erosion (e.g., road building, logging, mining, and grazing) accelerate the delivery of fine sediments to streams and the accumulation of fines in streambeds (Bryce et al. 2008).

Fine sediment levels in Lick Creek may impact some aquatic species normally associated with clean water. Stream habitat surveys in 2013 found embeddedness ranged from high

in the downstream reaches to low in the uppermost reach and that was similar to the amount of fine sediment found in the stream (Figure 3.8- 3). As in other recent studies, fine sediment was consider to be <2 mm (Relyea et al. 2012).

Relyea et al. (2012) found that all the macroinvertebrate species (206 taxa) they examined were found in streams with up to 26% fine sediment; however, at higher fine sediment levels taxa started disappearing. Impairment began occurring between 10 and 20% deposited fine sediment for certain sensitive species (Bryce et al. 2008).

Large wood, a measure of habitat complexity and quality, appears to be near natural levels in Lick and Lost Horse creeks, and less than adequate in lower Rock Creek (Table 3.8-1). The future supplies for large wood (large trees growing near the stream) also match the existing supply pattern.

Native fish evolved under historical fire regimes, and the disturbance to streams from forest fires resulted in a mosaic of diverse habitats. In the last century, fire suppression has increased homogeneity of terrestrial and aquatic habitats in the headwaters of the analysis area; increasing the likelihood of large, intense forest fires. In the analysis area's lower elevations, management by logging and prescribed fire has been much more intensive (see Silviculture and Fuels and Fire sections of the EIS).

The analysis area is susceptible to wildfire. The most severe effects of fire on native fish populations are expected where fish populations have become fragmented. The connections among the fish bearing streams in this area and the river are affected by human activities and natural events such as drought. An effective strategy to ensure persistence of native fishes against the effects of large fires would be the restoration of aquatic habitat structure and life history complexity of populations (such as restoration of migratory native trout populations) in areas susceptible to large fires (Gresswell 1999).

Although water management is not directly related to the proposed activities it is addressed to provide an overview of the environment that native fish in this area experience. Privately owned water rights allow for dewatering of Lost Horse and Rock creeks. Unscreened ditch headgates also divert native fishes from the stream. Lick Creek is partially obstructed where the privately owned Lost Horse Feeder Canal maintenance road crosses Lick Creek. The Lake Como dam is a barrier to upstream movement of fish in Rock Creek.

3.8.3.1 Desired Condition

A desired condition ensures that the proposed actions aid the conservation of bull trout (ESA section 7 (a)(1)) and ensures that activities are not likely to jeopardize continued existence of bull trout or adversely modify designated critical habitats (ESA section 7 (a)(2)). Similarly, the desired condition for other native fish, such as westslope cutthroat trout, would be maintenance, security, and enhancement of native fish populations, especially the genetically pure components (MTFWP 2007).

Desired conditions include achieving the riparian goals of INFISH (1995):

- Stable and productive riparian and aquatic ecosystems (INFISH 1995; Goal 1). Ecologically diverse riparian corridors are maintained by active natural disturbance regimes, with fire playing an important role in shaping the heterogeneity of riparian vegetation communities.

- Stream channel integrity, channel processes, and sediment regime under which the riparian and aquatic ecosystems developed
- Instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges
- Natural timing and variability of the water table elevation in meadows and wetlands
- Diversity and productivity of native and desired non-native plant communities in riparian zones
- Riparian vegetation sufficient to:
  - Provide an amount and distribution of large wood characteristic of natural aquatic and riparian ecosystems
  - Provide adequate thermal regulation within riparian and aquatic zones
  - Achieve rates of surface erosion, bank erosion, channel migration characteristics of those under which communities developed
- Riparian and aquatic habitats necessary to foster the genetic fish stocks that evolved within project area, and
- Habitat that supports populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations and contributes to the viability of riparian-dependent communities.

Projects meant to move toward desired conditions for these watersheds should be prioritized in context with their importance at a larger scale. For example, the Bull Trout Conservation Strategy (2013) aids in focusing resources in the areas most important to bull trout populations. In this project area, Lost Horse Creek is listed as an important area for bull trout.

Riparian Management Objectives

A comment during the DEIS review period expressed concern that the RMOs were not adequately addressed.

INFISH designated four objectives for fish habitat features in forested ecosystems: pool frequency, water temperature, large woody debris, and width to depth ratio. These objectives are referred to as Riparian Management Objectives (RMOs). The RMOs provide criteria to measure progress toward attainment of riparian goals. Goals are similar to *Desired Conditions* (Table 3.8- 1).

Lost Horse Creek exceeds the INFISH RMOs for large wood. Lost Horse Creek does not meet the RMO for pool frequency, water temperature, and width to depth ratio.

Lick Creek exceeds the INFISH RMOs for pool frequency and large wood. It does not meet the RMO for water temperature and width to depth ratio.

Water levels in Rock Creek and along Lake Como Reservoir, on the southern edge of the project, are highly regulated by the Lake Como Dam. The regulation of water cause extreme high flows and extreme low flows that alternate unnaturally. The Forest has not invested in surveys of this lower segment of Rock Creek. Cursory observations by the

fisheries biologist are that its riparian areas and channel conditions are below reference conditions in all four fish habitat features.

RMOs were assessed with:

- 2013 I-walk habitat surveys of Lick Creek
- 2014 Large wood survey of Lost Horse Creek
- 2013 & 14 Water temperature data loggers (Lick and Lost Horse Creek)
- Habitat Data Forms - Lost Horse Creek (1995)

Table 3.8- 1: Riparian Management Objectives and the Existing Condition of the Three Major Streams in the Analysis Area.

WATERSHED	POOL FREQUENCY (POOLS PER MILE)		WATER TEMPERATURE (°F)		LARGE WOOD (PIECES PER MILE)		WIDTH : DEPTH	
	RMO	EXISTING CONDITION	RMO	EXISTING CONDITION	RMO	EXISTING CONDITION	RMO	EXISTING CONDITION
Lost Horse Creek	26	14	<59	68	>20	77	<10	28
Lick Creek	96	145	<48	61	>20	53	<10	20
Rock Creek	56	Low	<59	High	>20	Low	<10	High

3.8.4 Environmental Consequences

3.8.4.1 Methodology

Data from field surveys conducted by Forest Service, State of Montana and University of Montana fish biologists were reviewed and summarized for the project. These included electrofishing surveys, snorkeling observations, aquatic habitat inventories, and inventories to classify riparian areas in the project area into the categories prescribed in INFISH (1995).

Scoping comments were reviewed to ensure that the evaluation of alternatives addressed commenters' issues and concerns.

The draft BA uses "A Framework to Assist in Making Endangered Species Act Determination of Effects For Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale" (USFWS 1998b), with that information incorporated into this document. The recently completed "Conservation Strategy for Bull Trout on USFS lands in Western Montana" (USDA Forest Service 2013) was also used. These citations and those listed as References were used to assess the alternatives, and compare them to the desired condition.

Incomplete and Unavailable Information

The size of aquatic species populations is extremely difficult to ascertain with precision. Availability of funds and time limited survey extent and intensity. The presence and absence of species, as well as general qualitative statements of population sizes were used to locate and evaluate important areas and issues.

Complex interactions among aquatic species, and their response to changes in fire regimes, vegetation types, and other disturbances, could result in unexpected effects, especially when considering unprecedented and predicted climate changes. Climate trends and literature assessing the effect of climate change were reviewed and incorporated into this analysis.

Spatial and Temporal Context for Effects Analysis

The area evaluated for this analysis encompassed the Rock, Lick, and Lost Horse watersheds (Figure 3.8- 4). The Bitterroot River connects these watersheds, and the connecting river segment is included in the analysis area. Including the Bitterroot River allows for incorporating the cumulative effects of activities upstream, and provides a basis for assessing the changes that could affect resources in the river downstream of the project area.

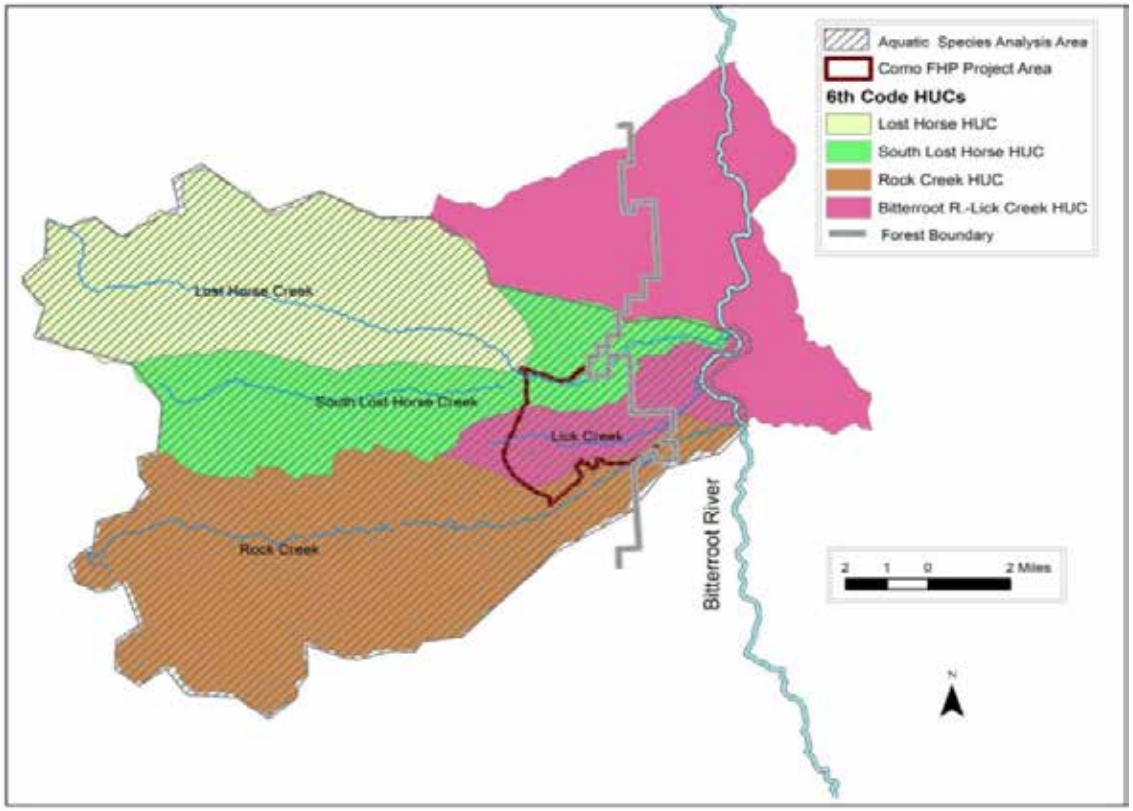

Figure 3.8- 4: Fish Analysis Area in Comparison to HUCs. The striped area represents the analysis area for aquatic species and their habitats. The HUCs are also displayed. Note that if the Bitterroot River -Lick Creek HUC were used, rather than a watershed boundary, the analysis area would extend across the river, well beyond the influence of the proposed project.

Table 3.8- 2 displays the relationship between the size of the fisheries analysis area and the size of the project area within the analysis area. The analysis area is about 20 times larger than the project area. The table also displays the amount of wilderness in each subwatershed. This is important because the minimally developed wilderness in the headwaters buffers the effects of management.

Approximately 77% of the Lick Creek subwatershed is within the project area (Table 3.8-2). This highlights the project area's potential to impact the relatively small Lick Creek subwatershed more than the other two subwatersheds.

The effects analysis for fisheries uses the watershed boundaries for the stream reaches and aquatic habitat that could be affected by the project. The standard USGS hydrologic units were not used to define the analysis area because their boundaries incorporate small watersheds that are unaffected by the project (Figure 3.8- 4). Parts of the biological assessment for bull trout, review by the USFWS, generally uses the6th code hydrologic units.

In this report "short-term" refers to effects lasting less than two years. Long-term effects are those lasting more than two years. The timeframe for cumulative effects varies by the type of activity and effect. For example, there is a short-term sediment increase produced from road decommissioning that often lasts one or two years, followed by a positive long-term effect as erosion rates decrease as vegetation become established.

Table 3.8- 2: Comparison of the Fish Analysis Area with the Project Area, and the Area in Designated Wilderness by Subwatershed.

SUBWATERSHED (6TH LEVEL WATERSHED NAME & CODE)	PROXIMITY OF FISH-BEARING STREAMS WITHIN PROJECT AREA BOUNDARY	FS ACRES WITHIN FISH ANALYSIS AREA	FS ACRES IN PROJECT AREA	PERCENT OF PROJECT AREA WITHIN THE FISH ANALYSIS AREA	PERCENT WATERSHED IN WILDERNESS
Rock Creek (170102050805)	Rock Creek is beyond the project boundary. Only intermittent tributaries are in the project area	35,564	501	1.4%	84%
Lick Creek (170102050807)	Lick Creek runs through the middle of the project area	4,734	3670	77.5%	0%
Lost Horse (170102050601 & SF Lost Horse 170102050602)	Lost Horse Creek is along the northern project boundary	64,311	1508	2.3%	19%
Total or Average		104,609	5,679	5.4%	40.2%

The effects discussion assumes that appropriate best management practices (BMPs) and design criteria for timber harvest and roads will be implemented for the action alternatives. Applicable BMPs are listed in Appendix A of the EIS. Monitoring confirmed that effects of harvest are generally within analysis predictions, with minor, localized exceptions (Monitoring Item 17, Forest Plan Monitoring Report 2009, Rashin et al. 2006).

As an overview, the number of miles of near-stream roads, in each analyzed watershed, was tabulated Table 3.8- 3). Also, cumulative effects considered in this analysis are introduced in Table 3.8- 4.

Table 3.8- 3: Road Data by Subwatershed Used to Assess the Effect of Existing Roads on Streams

	LOST HORSE	LICK	ROCK
Square miles in the Subwatershed	72.0	7.4	55.5
Miles of Road	42.6	29.4	18.8
Road Density (miles/ square mile)	**0.59**	**3.97**	**0.34**
Number of Road X Stream crossings	39	26	6
Density of Road X Stream crossings (number/square mile)[1]	**0.54**	**3.5**	**0.1**
Roads in Analysis Area w/in 300' of Perennial Streams (mi.)	12.19[2]	0.88	3.23

[1] The database shows only 1 stream/road crossing in the Lost Horse portion of project area. However, field reconnaissance reveals 4 road/stream crossings in the Lost Horse subwatershed in the project area. The unaccounted three crossings are intermittent drainages.
[2]This number was reported as 2.06 in the DEIS, which only accounted for the South Fork HUC. 12.19 is the correct number for the entire Lost Horse watershed.

3.8.4.2 Environmental Consequences of Alternative 1 – No Action

Direct Effects

There are no direct effects from the no action alternative.

Indirect Effects

Overall, indirect effects of the No Action Alternative are negligible. There is a potential for minor negative effects from the No Action Alternative because it maintains the risk of uncharacteristically severe wildfire. Interactions between insects and fire as agents of forest disturbance have many implications for stream dynamics, sustainability, and resilience, but the interactions are poorly understood, especially at landscape scales.

Treatment options, including no action, have consequences. There is general agreement that removing and reducing fuels will reduce fire intensity, but variations in the landscape create high variability in the effects of specific fuel treatments. For streams and aquatic organisms, a fire's severity makes a difference. How fires burn is often more important than if an area burns. Severity is often related to fire frequency—less frequent fires are often more severe, simply because there is more fuel to burn (Luce et al. 2012).

There are risks associated with not treating fuel to reduce wildfire. However, fire plays an important role in western forests, and in the streams running through them. Similarly, Insects, including bark beetles and defoliators, are major disturbances that, along with fire and wind, shape the area's streams and their structure.

Even in areas where management has been light-handed, the landscapes are always changing. Most places are in some state of evolution from disturbance. Interactions between insects and fire as agents of forest disturbance have many implications for stream dynamics, sustainability, and resilience, but the interactions are poorly understood (Luce et al 2012).

Data support the conclusion that native fish in the Bitterroot River and their habitats evolved adaptations to disturbances from fire (Sestrich 2005). Equally recognizable is the concept that aquatic populations may not be resilient to changing fires regimes resulting from changing climate.

The road and borrow pit restoration work planned in association with the vegetation treatments of the action alternatives would not be implemented. This would result in the

existing roads being in a slightly more erosive state, unnecessarily adding fine sediment to streams, until these roads are improved.

The effects of not undertaking thinning, prescribed fire, or a combination of the two are not clear. Microclimates in the riparian areas differ from the more frequently monitored uplands. Riparian areas have different fire frequencies and more plant species which complicates the accuracy of predicting longer term consequences from thinning or fuel treatment (Six and Skov 2009; McIver, J. et al. 2013).

Based on the expected accumulation of forest fuels that would occur with selection of Alternative 1, the risk of high fire severity may increase slightly over time (Hessberg, et al. 2005). The expectation is that the No Action Alternative would result in negligible risk to future amounts of stream shading and water temperatures.

Uncharacteristically severe wildfire could cause fish mortality by heating from the fire or from declines in water quality and quantity after the fire (Burton 2005). However, for the post-fire flood events to cause fish mortality there needs to be a severe wildfire followed by extreme storms. If these events occur, declines in water quality and quantity can be severe (Wondzell and King 2003). Regardless of the alternative chosen, only a small portion of the watershed contributing area would be thinned, and much of the assessment area would retain the current risk for high-severity fire. Therefore, it is unlikely that foregoing the thinning treatments would impact the characteristics of riparian vegetation to the extent of negatively affecting aquatic habitat conditions.

The beetle population would likely continue causing mortality in the riparian trees at similar rates as would occur in the action alternatives. This similarity is because thinning within the riparian areas is uncommon in the action alternatives.

The amount and size of large wood in streams and on floodplains would not change. Large wood in streams and floodplains contributes to habitat complexity by adding cover and maintaining features such as pools, gravel bars, and backwater areas. Large wood also provides nutrients to stream, and substrate for aquatic invertebrate production (Dwire et al. 2010, Montana DNRC 2005).

Tree thinning is expected to assist in managing the negative impacts associated with beetle and wildfire. Thinning may also help forests cope with changes in climate in a more predictable manner than without treatment (Luce et al 2012).

Cumulative Effects

The cumulative effects analysis area for aquatic species includes public and private lands within the Lost Horse, Lick, and Rock creeks' subwatersheds and the section of the Bitterroot River that connects these tributaries (Figure 3.8-4).

The non-NFS lands are typically more developed and their stream channels tend to be more altered. Relatively speaking, the NFS lands can be viewed as a refuge for the native fish and aquatic species. This requires greater management consideration for fish and aquatic resources. The cumulative effect is that the positive and negative consequences explained in the indirect effects section become more substantial.

The most probable cumulative effect of the No-Action alternative is the continuation of present trends of increasing tree density and moisture stress in the upland ponderosa pine trees. As explained above, this has the potential to lead to increases in beetle-caused tree mortality and the risk of uncharacteristically severe fire (see Silviculture and

Fuels sections). These upland effects have the potential to influence the riparian areas and the aquatic habitats.

The no-action alternative would maintain, and over time slightly increase, the risk of short-term decreases in the westslope cutthroat trout populations in the three major creeks in the project area. There would be even less effect on bull trout and their habitat because they are only in Lost Horse Creek and primarily occupy an area a few miles upstream of the project area.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Table 3.8- 4: Summary of the Primary Cumulative Effects to Aquatic Species and Habitats in the Cumulative Effects Analysis Area.

CONNECTED ACTION	PAST, PRESENT, OR FORESEEABLE	SUB-WATERSHED	EXTENT	PRIMARY EFFECT, INTENSITY AND DURATION	CUMULATIVE EFFECT
Water withdrawal	Past, Present, and Foreseeable	All 3	Extensive	Rock – Severe Lick – Moderate[1] Lost Horse - Severe All Long term	Loss of habitat quantity and quality (increased temperatures, reduced productivity, and loss of access to cover and other habitat features)
Lick Creek Riparian and Channel Improvement Project	Past - 1996	Lick Creek	0.5 mile of stream	Positive Minor, Long term	Positive – Large wood has improved complexity and planted trees are producing shade and cover.
Timber Harvest on NF prior to Forestry BMPs[2]	Past – prior to 1990	Lick Creek	Extensive	Negative, Central to existing condition, Long term	Removed much of the large wood in RHCAs, and road building era
Timber Harvest on NF After Forestry BMPs	Past – prior to 1990	Lick Creek	Extensive,	Negative, Minor, Short and Long term	Legacy roads retained
Permitted Cattle grazing on the Forest	Past, Present, and Foreseeable	Lick and Lost Horse	Concentrated in about 2 miles of Lick and Lost Horse Creeks	Lick – Moderate short and long term Lost Horse - Negligible	Bank sloughing observed in 2013 at Lick Cr. No effects observed along Lost Horse Creek in 2013.
Dispersed Camping with vehicles	Past, Present, and Foreseeable	All 3	Scattered	Rock – Minor Lick – Minor Lost Horse - Moderate All Long term	Loss of streamside vegetation, include large wood, and soil compaction. Dumping and sanitation. Most egregious site is along Lost Horse Creek at intersection of Forest roads 5621 and 429.
Wildfires	Past	All 3	Scattered	Negligible	Although several wildfires have occurred in the analysis area, none are continuing to impact native fish or other aquatic species or habitats.
Wildfires	Foreseeable	All 3	Unpredictable	Unpredictable	Wildfires will occur in the analysis area. Extent and severity are difficult to predict.
Lost Horse Road	Past 1993 &	Lost Horse	Extensive	Positive – Minor Long	Reduced streamside parking, road stability

CONNECTED ACTION	PAST, PRESENT, OR FORESEEABLE	SUB-WATERSHED	EXTENT	PRIMARY EFFECT, INTENSITY AND DURATION	CUMULATIVE EFFECT
Reconstruction Project	follow-up maintenance in 2005 -present			term	improved. Positive effect reduced by increased traffic and recreational activity.
Lost Horse Quarry	No Effect	Lost Horse	Na	None	Although project was considered "no effect" it was included in this table because the project was somewhat controversial
Lick Creek Bridge Replacement	Past 2005	Lick	1 Site	Short term effect during construction	No cumulative effect at this time. Bridge replaced an older bridge for safety purposes not for fish passage
Fuel Reduction (prescribed fire and thinning of understory trees)	Past, Present, and Foreseeable	All 3	Scattered	Negligible short term effect, Mid-term benefit	Reviews of thinning and fuel treatment projects after their implementation (2000 to 2013) has found no evidence of their impact to aquatic habitats.
Developed Recreation - Lake Como	Past, Present, and Foreseeable	Rock	1 Large Site (~500 acres)	Minor, Long Term	The development and the use of the recreation area have a relatively minor effect on aquatic habitat in Rock Creek. The overwhelming effect is the management of water storage and release from the Lake Como Reservoir.
Developed Recreation - Twin Lakes	Past, Present, and Foreseeable	Lost Horse	Limited	Minor, Long Term	The development and the use of the recreation area have a minor effect on aquatic habitat in upper Lost Horse Creek. The larger effect is the management of water storage and release from the Twin Lakes Reservoir.

[1] This estimate of effect is based on a review of aerial images of stream conditions and water withdrawals on private lands.
[2] The Forestry Best Management Practices (BMP) became part of the Protection of Forest Resources Law in 1989. When the first audit was conducted in 1990, 78% of practices met or exceeded BMP standards. In 1998 the audit results achieved a 94% rating, and audit results have met or exceeded that rating ever since (MTDNRC 2012).

3.8.4.3 Alternative 2 – Proposed Action

The effects of roads dominate the discussion in this section. From an aquatic species and habitat viewpoint, roads are the most influential factor that is within the scope of this project (Valdal and Quinn 2010). Other project features, such as harvest or burning would be designed to avoid impacts to RHCAs. Design features are proposed to reduce the effects of roads on streams, but many of their effects cannot be totally eliminated (i.e. maintenance that temporarily and repeatedly effects sediment accumulation in streams). Proposed road construction, maintenance, and obliteration will influence amounts of erosion from roads, change shading along near-stream roads, and indirectly change pool frequency and habitat quality. Habitat quality includes the amount of instream large wood and interaction between the channels and the floodplain, and connectivity of aquatic habitats (Stromberg et al. 2013).

All the action alternatives (2, 3, and 4) include these key features:

- Approximately 0.6 miles of previously undetermined road would remain open
- 3.1 miles of previously undetermined road would be stored
- 3.5 miles previously undetermined road would be decommissioned
- 0.5 mile of national forest system road would be decommissioned
- Erosion control at the active borrow pit would alleviate a substantial sediment source to a Lick Creek tributary.

From a fish and aquatic habitat perspective the key features of Alternative 2 are:

- Construction of approximately 1.7 miles of new system road, 2.1 miles of temporary road, and 2.6 miles of tracked line-machine (TLM) trail
- Commercial timber harvest on 1,086 acres
- All treated units may need additional non-commercial thinning, slash piling, and slash treatment.
- In addition to the possible prescribed fire in harvest and thinning units, low severity fires would be used on 765 acres and moderate severity fire would be used on 542 acres

Design Features

Chapter 2 lists the design features, grouped by the resource that prescribes the feature. Monitoring reports and field notes substantiate the effectiveness of these features (Forest Plan Monitoring Report 2008, Brassfield 2012).

Direct and Indirect Effects

Harvest

In Alternative 2 there are very minor direct effects expected from the proposed harvest of trees. Nearly all of the commercial harvest will occur outside the RHCAs. There are a few exceptions where skid trails and landings would be within the RHCA to one intermittent tributary to Lick Creek, but their effects are negligible. These exceptions are:

- On the lower slope of Unit 39 along NFSR 5608. A channel in this area has sections of intermittent and perennial flow. It has been prescribed to have a 100-foot RHCA. Also in this area is an OHV user-built trail in an adequate location for a skid trail. Although this trail is within the RHCA for approximately 150 feet, it would cause less ground disturbance to use

this established OHV trail within the RHCA than to create new additional disturbance outside the RHCA. The OHV trail would retain a 70-foot undisturbed area along the channel to act as a sediment filter strip.

- At this same general location, a wide area in NFR 5608 is proposed for a landing. This landing would be as close as 80 feet from an intermittent channel. There would be less disturbance to the environment to use this existing disturbed area rather than creating a new landing and disturbance along the outer boundary of the RHCA (field notes and map rkb 08/26/2013).

To summarize Alternative 2, there are few indirect effects of harvest. The effects include disturbance to a few sites (along units 23 and 39) where landings and skid trail will be within the RHCA and these have a low risk of effecting shade to intermittent and perennial fishless streams.

Non-commercial Thinning and Fuel Treatment

Non-commercial thinning units sometimes include a portion of RHCAs when thinning is likely to attain riparian management objectives (RMOs; INFISH 1995). The RMOs relate to attaining functioning channels with stable banks, cold water, and large wood. There are negligible direct effects associated with non-commercial thinning. Thinning can occur within 50 feet of wet areas when the intent is to improve growth of the remaining trees and provide resistance to fire, insects and diseases.

Tree thinning is expected to be a step for managing the negative impacts associated with beetle and wildfire. It may also serve to help forests cope with a changed water balance in a more predictable manner than without treatment (Luce et al 2012).

Fuel treatments associated with non-commercial thinning may include burning. Fire used in thinned sites is carefully controlled to benefit the remaining trees and is not expected to adversely affect aquatic species or their habitats.

Prescribed Fire

There are no expected short-term adverse effects from the proposed prescribed fire that includes 3,320 acres. Based on field observation on the Bitterroot National Forest, there is very low risk of fire escaping control and having more than superficial short-term effects. The mid to long-term effects of prescribed fires would likely be slightly beneficial. Prescribed fires would tend to create areas where the risk of uncharacteristically severe fire would be reduced.

Fire lines, including handline, are not expected to occur in RHCAs. In and near the RHCAs, prescribed fires would be controlled by lighting technique, timing with weather conditions, and using water (hose-lines and pumps). Lighting fire (hand ignition) is allowed in the RHCAs, but not in wetlands. Fire is allowed to fire to back into wetlands. The effect of using water to control fire spread is slight because of the amount of water required, season of use (prescribed fires are not used in drought periods), and the standard operating procedures of pump and water use during prescribed fires.

Riparian areas frequently differ from adjacent uplands in vegetative composition and structure, geomorphology, hydrology, microclimate, and fuel characteristics that often contribute to lower severity burns. Adaptations by riparian and aquatic ecosystems to the effects of fire may also moderate the effects of fire. Forest fisheries biologists and hydrologists monitored several prescribed burns that have been completed on the Forest (USDA Forest Service, 1998: pg 69; PF, FISH-7). Their monitoring indicates that the majority of the RHCA acreage does not burn during prescribed fires, and where fire does back down into the RHCAs, it tends to burn at low severity in a spotty pattern. These factors likely contribute to the lack of effect on native trout abundance in streams disturbed by fire (Valdal and Quinn 2010).

Roads in General

Road-related activities proposed in Alternative 2 have the potential to affect aquatic habitat in positive and negative ways. The condition of the road surfaces and associated drainage features along the road prism, and the amount of traffic on a road, influences the amount of sediment generated. Maintenance retains the shape and drainage features in a road. Relative to poorly maintained roads, adequate maintenance of moderately and heavily used roads can reduce long-term sediment production (Burroughs and King 1989). Conversely, road surface maintenance can also result in short-term accelerated erosion from water handling structures, especially roadside ditches. This is because maintenance often loosens the road surface exposing fine particles to erosion. Frequent maintenance can result in chronic sediment contributions to streams, particularly where there are clear pathways from roads features to stream channels.

Road density was used to assess the impact of road maintenance on aquatic habitat. An assumption was that a similar amount and quality of road maintenance would occur. Table 3.8- 5 compares alternatives based on road density. Alternative 2 would decrease road density by 15% in Lick Creek and by negligible amount in the other subwatersheds. This change in Lick Creek has the potential to have a long-term positive effect on Lick Creek.

Table 3.8- 5: Changes in Road Density by Alternative and by Subwatershed

	ROAD DENSITY LICK CREEK	PERCENT CHANGE FROM NO ACTION	ROAD DENSITY ROCK CREEK	PERCENT CHANGE FROM NO ACTION	ROAD DENSITY LOST HORSE CREEK	PERCENT CHANGE FROM NO ACTION
Alternative 1	3.97		0.34		0.68	
Alternative 2	3.38	-15%	0.33	-2%	0.67	-1%
Alternative 3	3.26	-18%	0.33	-2%	0.65	-5%
Alternative 4	3.34	-16%	0.33	-2%	0.66	-4%

Alternative 2 would be unlikely to change to the erodability, size and proximity of existing roads to the magnitude that there would be measurable effects to aquatic habitats. The effects of individual roads are categorized in Table 3.8- 5. The effect of proposed road activities on the aquatic species and habitat are based on field observations of the existing condition of roads, road proximity to aquatic habitat, road grade, treatments prescribed and the predicted amount of future use. The decrease in road density shown in Table 3.8-5 suggests that cumulatively and over the long-term, proposed road management may slightly improve aquatic habitat.

The amount of haul is a factor related to the amount of road maintenance required. Alternative 2 would produce 5.7 mmbf and that equates to approximately 1270 truckloads (4.5 mbf/truck) Table 3.8- 7). The loads would be split between the routes of:

- Access via Lake Como into Rock and Lick creek watersheds and
- Access via Lost Horse and into lower Lost Horse and Lick Creek watersheds

The main haul routes (Lost Horse 429, Como Road NFR 1111; Lick Creek NFR 5621) are stable, reasonably well maintained, and have bridges over the fish-bearing streams that minimize sediment input and allow fish-passage. One culvert in an ephemeral drainage of Lick Creek in NFR 5621 would be replaced as it has substantially eroded over time.

Table 3.8- 6: Effect of Proposed Road Activities, Alternative 2, on the Aquatic Species and Habitat. See Table 3.6-7 in the Soils sections for details on the current status and treatment proposed for each road. Effects are based on field observations of the existing condition, road proximity to aquatic habitat, road grade, treatment prescribed and the predicted amount of future use. New construction is in Italics and Reconstruction is in bold.

DRAINAGE	ROAD TREATMENTS THAT RESULT IN POSITIVE CHANGES TO THE AQUATIC ENVIRONMENT[1]	ROAD TREATMENTS THAT HAVE NO MEASURABLE EFFECT ON THE AQUATIC ENVIRONMENT	ROAD TREATMENTS THAT RESULT IN NEGATIVE CHANGES TO THE AQUATIC ENVIRONMENT
Lost Horse	62945 (0.16)	13289 (0.47 mi) 13290 (0.53) 62925 (0.21) 62933 (0.91) 62940 (0.87) 62944 (0.83) 62945 (0.22) 62963 (0.56) Subtotal = 4.65 miles **62945 (0.40)** **Unit 41 (0.97)** **Subtotal = 1.37**	
Lick Creek		13231 (1.04 mi) 62930 (0.41) 62932 (0.69) 62933 (3.0) 62934 (0.79) 62935 (0.27) 62937(0.37) 62938 (0.64)[2] 62939 (0.33)[2] 62940 (0.9) 62942 (0.56) 62944 (0.83) 62965 (0.23) 62966 (0.08) 62967 (0.52) 62972(0.23) 62973 (0.25) 62974 (0.58) Subtotal = 11.72 miles	*62932 to BRID (0.59)*[2]
Rock Creek	62966 (0.10)	62966 (0.71) 62968(0.22) 62968A (0.03) Subtotal = 0.96 miles	

[1] Positive effects of road treatments are often preceded by short-term disturbance involved in restoration activities. The positive effects are usually realized after 1 to 2 years and effects of recovery are long-term.
[2]These roads include channel crossing or impact to RHCAs. In the case of 62932 the impact to a RHCA is the negative part of the road, not the whole length. In the case of 62939 and 62938 there are stream crossing where the road would be treated to have less effect. These are minor benefits not accounted for in the table.

It is difficult to predict the effects of road traffic on erosion and therefore streams. It varies due to differences in traffic intensity, weather (precipitation duration and intensity, or lack of precipitation),

differences in road materials (gravel quality and depth), or the characteristics of the drainage area that include: slope, length, surface area, and rutting. Consistent road maintenance and restrictions on road use while the road is too wet or dry, contribute to minimizing the effects of traffic on roads and the effect to aquatic habitat (Sheridan et al. 2006).

Lick Creek drainage has several stream crossings (Table 3.8- 3), but not many sections of road that parallel streams. The number of stream crossings is important because stream crossings are often on curved sections where the road follows the contour. Fine road materials detached from roads by trucks is higher on curved sections of road. The torque applied to the road surface by the vehicles' tires is greater while the vehicle is changing direction (Sheridan et al. 2006). This can be observed in the field by looking for an accumulation of loose road surface material on sharp corners.

Assuming that the southern (Como) haul route and the northern (Lost Horse) haul route are used somewhat equally, there would be 600 to 700 truckloads (Table 3.8- 7) traveling down each of these roads. With the quality and maintenance levels expected for the forest roads in the area during the implementation of Alternative 2, the level of truck traffic has the potential to increase the sediment concentration of water discharging from the roads. Although traffic is discouraged during snowmelt and runoff events there are periods when operators push the limits of the design criteria. The result can be wheel ruts that channelize water, inhibit lateral drainage of the road profile, and cause accelerated erosion of the road surface (Haacke Sale Unit Log, Brassfield 2012).

The effect of log-hauling on forest roads in the project area is expected to be difficult to observe or measure in Lost Horse and Rock Creek subwatersheds; and measureable near roads in the Lick Creek subwatershed. The difference between drainages is related to the number of crossings of the smaller drainages in the Lick Creek subwatershed. Secondary roads are generally maintained to a lower standard, but have less traffic on them. These routes would be likely to have minor to moderate effects on non-fish bearing streams, including perennial streams, intermittent streams, and ephemeral channels. Stream-road crossings in the project area have been evaluated and those in need of work to meet BMP standards would be upgraded prior to haul. BMPs are expected to reduce the potential erosion throughout the haul routes.

The one road crossing of mainstem Lick Creek is a relatively flat area and the crossing is a bridge with stable approaches. Due to these characteristics, this crossing is likely to produce negligible sediment.

Table 3.8- 7: Harvest Volume and Truckloads by Alternative

	THOUSANDS OF BOARD FEET	MILLIONS OF BOARD FEET	TRUCKLOADS
Alt 2	5703	5.7	1,267
Alt 3	5182	5.2	1,152
Alt 4	4730	4.7	1,051

The only road-related fish barrier in the project area is the Lick Creek crossing of the Lost Horse Feeder Canal Road. This is a privately owned road. This culvert is probably a partial barrier as some sizes of trout could pass through the culvert at some flow stages. Brook trout are the dominant species in Lick Creek. Brook trout are a non-native and invasive species that competes with native cutthroat trout. Therefore, at this time, replacement of this culvert is a low to moderate priority if the culvert were to be placed on the Forest's list of culverts to be upgraded.

Specified Road Construction

There are four segments totaling 1.74 miles of new specified road construction proposed in Alternative 2. Specified road segments would become part of the long-term transportation system.

Road construction effects to aquatic resources in western Montana vary based on proximity to water and riparian areas, grade of the proposed road, quality of the road surface and drainage features, and topography and landscape stability.

The only segment of new system road that could directly affect aquatic habitat is the 0.59-mile connector between NFSR 62932 and the Lost Horse Feeder Canal Road. It is in the Lick Creek watershed and would be within the RHCA of perennial springs and wetlands and has a moderate risk of contributing minor amount of sediment and slightly changing the temperature of the microsite. There would be no substantial direct effect to the wet areas, and no measurable affect to fish habitat. This is based on the distance of the road to the springs, side slopes (< 30%), and a result of designing and constructing adequate road drainage.

Indirect effects of roads are that they get used as access to firewood cutting, trash dumping and illegal cross-country travel. Even though there is a Forest-wide prohibition against cutting firewood within 150 of waterways, it happens. This indirect effect would be limited in time because these new system roads would be placed in storage after harvest and associated activities.

The other specified road construction segments would not be likely to affect aquatic habitats as they would be outside the RHCA and include design features that minimize the risk to aquatic species or their habitats (such as avoiding landslide prone areas, controlling road grade, and using proper drainage techniques).

The specified road planned to access Unit 50 is outside the 300-foot RHCA of Lost Horse Creek. No sediment from this road would be expected to reach the RHCA or Lost Horse Creek. There would be no effect to the amounts of shade or large wood along Lost Horse Creek's channel or floodplain.

Temporary Road Construction and Rehabilitation

In Alternative 2, an estimated 1.4 miles of temporary road would be required. The risk of detrimental effects from the proposed segments is very low and would become less as natural recovery occurs after the activities are done. The reasons for the low risk of detrimental effects from the temporary roads are that the roads are outside of the RHCAs, there are no landslide prone areas affected, and the roads are expected to be rehabilitated after harvest and associated activities are done.

All temporary roads, trackline machine trails, and excavated skid trails would be rehabilitated as part of the timber sale or stewardship contract. Rehabilitation activities would include recontouring, slashing, fertilizing, and seeding to restore soil productivity and hydrologic processes.

Forest fisheries biologists and hydrologists monitored four temporary roads in the 2001 Burned Area Recovery project that were constructed on uplands outside of RHCAs, and recontoured after use. Sediment did not move more than a few feet off the road shoulders, and there was no sediment delivery to streams (USDA Forest Service, 2006: pg 82). Tracked line machine trails were constructed, used, and recontoured in the recently completed Frazier Interface and Painted Rocks West timber sales. Similar to temporary roads, monitoring found that sediment did not move more than a few feet beyond the shoulders of the trail, and because of their considerable distances from the nearest RHCAs, there was no sediment delivery to streams (USDA Forest Service, 2006: pg 76; USDA Forest Service, 2007: pg 95).

Road Decommissioning and Storage Treatments

The transportation system across the project area has been reviewed by the IDT to determine the future needs for roads. This review included both Forest system roads and undetermined status roads. Table 3.6-8 includes current system roads and undetermined status roads that are proposed for decommissioning or storage in this project.

Approximately 3.48 miles of undetermined status roads are proposed to be decommissioned. The entrances of these roads may be blocked or recontoured. These roads have vegetation growing in them so there are no other treatments proposed to decommission them.

Table 3.8- 6 outlines the roads that effect aquatic species and habitat. The vast majority of road related activities in this project, including road storage and decommissioning, have negligible effects on the aquatic environment. Sediment mitigation measures included in all action alternatives include BMP improvements on six different stream crossing sites on FR5621 and FR5623, two of the major haul routes. Cumulatively and over the long-term there may be a measureable positive effect.

From an aquatic habitat perspective, the overall road density is high and would remain high in Lick Creek, but would drop from 4 to 3.4 miles per square mile. Although there only a few proposed decommissioning and storage treatments in this project that have noteworthy effects (Table 3.8-6), there are also relatively few road segments that closely parallel streams. The area's topography allowed for the creation of a road network that crosses streams and drainage perpendicularly, minimizing potential road sediment.

Although difficult to measure at the watershed scale, the sediment reductions that occur slowly over time as a result of road decommissioning and storage would slightly improve habitat for native trout and westslope cutthroat trout over the long-term. Reducing road density is advantageous to native trout. Road densities are well document as contributing to reduced productivity of trout streams. Recent studies also reinforce the conclusion that the potential for negative effects on trout abundance is a function of road density in the near-stream zone and not simply road density in the watershed (Valdal and Quinn 2010). There would be no substantial change to road densities in the near stream zone proposed in this project.

Monitoring data, literature, and model predictions, show that the decommissioning and storing of roads in Alternative 2 would contribute small amounts of sediment to streams in the immediate vicinity where culverts are removed and road fills recontoured. The ephemeral channel or dry swale locations of the culverts removed in this project result in most of the sediment being unlikely to enter fish habitat.

Two short lengths of roads currently on the transportation system in stored status will be decommissioned (NFSR 62939 and the end segment of NFSR 62945). NFSR 62939 has been grown over with vegetation and is not accessible by vehicle. This road is proposed to be decommissioned from the junction with NFSR 62925 to the end of the road (approximately 0.17 miles). No treatment of the road is required due to natural recovery. The entrance will be blocked to prohibit future motorized access. The road is currently used for non-motorized recreation and future non-motorized use would be allowed.

The last 0.16 mile of NFSR 62945 would be decommissioned and new specified road construction is proposed to connect with NFSR 62945 to provide access to Unit 50 and the adjoining plantation. The last 0.16 mile of NFSR 62945 will be obliterated. Skid trails connecting to the end of the road will also be decompacted and rehabilitated. This has a beneficial effect of protecting the wetland that is near the end of the existing NFSR 62945 route.

Road (NFSR 62936) and pit restoration would alleviate a substantial source of erosion that was observed to be contributing fine sediment to a tributary of Lick Creek.

Roads Temporarily Opened for Haul

A total of 3.23 miles of currently stored system roads would be re-opened for commercial thinning activities. These re-opened roads are proposed for log hauling and would need to be clear of

vegetation and the road surface improved to accommodate log truck traffic. The majority of these roads will be placed back into storage upon completion of log hauling.

The storage treatment will involve scarifying the road surface (scarification less than 6 inches in depth), seeding, and fertilizing. Establishing vegetation on the road would provide a less erosive road surface. Stored roads would not be used by motorized vehicles, but would be available for non-motorized recreation (NFSR 62937, 62938, and 62963).

A total of 3.1 miles of undetermined status roads were identified by the IDT as necessary for forest management and are proposed to become part of the transportation system. These roads are proposed to be opened to accommodate commercial thinning and log hauling. Vegetation will be cleared and the road surface improved. After the thinning activities, these roads will be stored. The entrances of these roads will be physically blocked.

Cumulative Effects

Stream fish and their habitats are particularly at risk of cumulative because watersheds accumulate and concentrate the effects of dispersed land uses over space and through time (Valdal and Quinn 2010 cite several authors).

Past Activities

Field reviews of the project area resulted in the observations of historical road and railway prisms along Lick Creek and some of the fishless tributaries. There were specific remote sites (not near any existing roads) that had some actively eroding areas, but were generally trending toward recovery.

A lack of large wood in Lick Creek, the size of the dominant trees in the floodplain, the presence of occasional apple trees, and larger old conifer stumps indicate harvest and other disturbances occurred and likely with very little regard for the quality of aquatic habitat (Iwalk habitat survey data, 2013).

This alternative would not add measurable negative effects to the already disturbed and recovering nature of the project area. When viewed at the larger scale of the cumulative effects analysis area for Fish and Aquatic Habitat (watersheds of Lost Horse Creek, Lick Creek, and a portion of Rock Creek) the cumulative effects of this alternative would be minor and slightly beneficial in overall effect. This is based on slightly reducing the risk of uncharacteristic wildfire, a lack of expected effect from the harvest and haul of timber, and the minor improvements in the road system.

Ongoing and Future Activities

The cumulative effects of Alternative 2 are an additive effect to an apparent long term state of accelerated sedimentation of Lick Creek (see Hydrology section for 303(d) impaired water quality listing details). The short-term negative impacts noted above are in addition to the dewatering that affects the three major streams in the analysis area, non-native fish species in all of the fish-bearing stream reaches in the analysis area, stream bank shearing, noted in 2013, from ongoing livestock activity in Lick Creek, and the impacts of disperse recreation increasing sedimentation and decreasing large wood in streams near the commonly used sites. However, after short-term disturbances, Alternative 2 would result in a minor long-term beneficial impact. The improved condition would result from activities that are designed specifically to address the sedimentation issue: addressing the erosion in the area of the Lick Creek Pit, BMP upgrades of haul roads (see Soils and hydrology sections for details), and decommissioning and storage of several other roads.

3.8.4.4 Alternative 3

In this alternative no new system or temporary roads would be constructed and no tracked line-machine trails would be developed. Approximately 2,224 acres forest would be treated to reduce

the susceptibility to mountain pine beetle related issues. Commercial timber harvest would occur on 1,010 acres and the remaining 935 acres would be non-commercial thin treatments.

All treated units would be followed with a post-harvest review to evaluate the need for additional non-commercial thinning, slash piling, and the type of slash treatment. A low severity prescribed fire would follow most of the treatments in commercial harvest units.

Outside of harvest or thinning treatment units there would be low to moderate severity fires prescribed on 2,170 acres. So, overall Fuels would be reduced on 3,105 acres using mechanical treatments and prescribed fire.

Design Features and Mitigation Measures

The design features for this alternative are included above. A key feature of this alternative was that it would not require the building of new roads.

Direct and Indirect Effects

Table 3.8- 5 outlines the effect of the Alternatives on road density. Alternative 3 would result in the largest overall decrease in road density in both Lick Creek (-18%) and Lost Horse Creek (-5%). Decreasing road density would be especially important in Lick Creek (Table 3.8- 4). In Lost Horse Creek the change in road density is not substantial because these roads tend to have less effect on streams and aquatic habitat. Several of the slopes drain to the Lost Horse Feeder Canal before the effect could reach Lost Horse Creek.

Generally the effects discussion in Alternative 2 mirrors the effects that would occur in Alternative 3 and will not be repeated here. There is one area where very minor impact could occur that is in addition to those described for Alternative 2.

- NFSR 62938 closely parallels an intermittent drainage of Lick Creek for the first 0.25 miles of the road. This intermittent drainage has a 100-foot RHCA prescribed. Along NFSR 62938 and within the RHCA there is a previously disturbed wide area that would be a logical location for a landing. The area has an approximately 50-foot with vegetated filter strip, and the disturbed area would maintain that filter strip, and not be widened beyond (field notes and map rkb 08/26/2013).

Table 3.8- 6 outlines the effect of proposed road activities. A positive aspect of Alternative 3 is that the one road that is listed as having an adverse effect, though minor, would not be constructed.

Table 3.8- 7 outlines the estimated number of truckloads of logs that would come from the commercial harvest. The effect of the traffic is too imprecise and cannot be accurately calculated. Generally, less traffic on gravel and native surface forest roads means less sediment and is better for aquatic habitat quality.

Cumulative Effects

Alternative 3 would result in a smaller road network that would reduce the cumulative impact of fine sediment in the project area, especially Lick Creek.

Other cumulative effects are the same as described for Alternative 2.

3.8.4.5 Alternative 4

Under Alternative 4, commercial timber harvest would occur on 1,154 acres and non-commercial thin treatments on 769 acres. As in other alternative the treated units would be followed with a post-harvest review that would determine the need for additional non-commercial thinning, slash piling, and the type of slash treatment. Low severity prescribed fire would follow most of the

treatments in commercial harvest units. In total, low to moderate severity fires would be prescribed for 2,075 acres.

Approximately 0.7 miles of new system road, 1.2 miles of temporary road, and 0.5 mile of tracked line-machine (TLM) trail would be constructed to access timber.

Aspen clones are treated in this alternative to promote habitat diversity. These areas, totaling 39 acres, are generally in and along wetland and seasonally wet soils. BMPs and design features would limit impacts to aquatic habitat to small (generally < 0.25 acre) isolated areas that should recover quickly.

Direct and Indirect Effects

Most of the effects of Alternative are very similar to Alternative 2. To avoid repetition, only the difference between the alternatives will be addressed here.

Direct effects to the areas treated to stimulate the deciduous (aspen) stands would only occur along non-fish bearing streams. The area in Lick Creek is along wet areas that are connected to Lick Creek via an intermittent stream. The risk of having any effect (sediment or temperature) to Lick Creek is very small. The areas treated in the Lost Horse drainage are upslope of the Lost Horse Feeder Canal. There is no risk of changes to fish-bearing streams because the unlikely effects of minor sediment or temperature changes would be absorbed at the canal and not reach the fish bearing stream. Most of the Bitterroot National Forest projects avoid management activities in wet areas in order to protect the ecological integrity of the sites (INFISH, USDA 1995). The deciduous stands rely on disturbance for persistence. Therefore, it is likely that the frequency and size of these stands are less than they were historically. The indirect effect of treating these stands is an increase in this limited habitat type, which will favor some aquatic and semi-aquatic species (amphibians and aquatic macroinvertebrates).

Design features would be used to limit the effects of mechanical impacts. For example, the deciduous stands of unit 74 would be accessed via a skid trail that lies between two wet areas. Use of the corridor would be limited to dry or frozen periods. Skidding during dry or frozen periods reduces soil compaction and depth of soil displacement when the area is crossed by equipment or when logs are pulled through the area. Access in unit 74 via this route also eliminates the need for more extensive temporary road that would go around the wet areas, and cross an additional ephemeral channel.

Table 3.8- 5 outlines the effect of the Alternatives on road density. Alternative 4 would result in a decrease in road density in both Lick Creek (-16%) and Lost Horse Creek (-4%).

Similar to Alternative 3 there is one area where very minor impact could occur that is in addition to those described for Alternative 2. Along NFSR 62938 there is an intermittent drainage with a 100-foot RHCA and there is a previously disturbed wide area that would be a logical location for a landing. The area would not be widened beyond the existing width.

Table 3.8- 7 shows the estimated number of truckloads of logs that would come from the commercial harvest. The difference in effect of the traffic among the action alternatives is much less precise than the number of truckloads. This is because the conditions of the road during the haul have more effect than the absolute number. For example, a few trucks on saturated roads can have much greater effect than several trucks on dry well-maintained roads. Timber sale contract provisions enforce BMPs (Appendix A) that limit haul traffic on wet roads, reducing the potential sediment effects.

A direct effect of Alternative 4 is fuel reduction and the reduction of insect and disease risk would occur on less area than in Alternatives 2 and 3. The differences in indirect effects on fish habitat between action alternatives (Alternatives 2, 3, and 4) would be imperceptible.

Cumulative Effects

The past, present, and reasonably foreseeable actions are the same as those described for Alternative 2.

3.8.4.6 Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All of the alternatives would comply with the fisheries and riparian related Forest Plan (USDA FS 1987) and INFISH (USDA FS 1995) standards and guidelines. They also meet fish and riparian habitat related regulations policies and plans (MTFWP 2007, USDA FS 2013).

Forest Plan management standards related to fisheries and this project (USDA Forest Service, 1987, II-20 through 33 and III-23 through 25) would be met by:

- Viable populations of cutthroat trout exist at this time and the alternatives would range from no effect to very minor effects.
- Watershed level analyses show that the effects of sediment on fish are existing and the alternatives would range from no effect to very minor effects.
- Activities are proposed in the action alternatives to reduce sediment delivery from existing roads and provide fish passage
- Minor changes in existing dispersed recreation would not be detrimental to riparian areas.
- Timber management in riparian areas would meet fisheries and water quality objectives.
- Stream channels and fish habitat would be maintained.
- Fish habitat improvement projects (Lick Creek Culvert replacement at NFSR 10051) would be scheduled to improve fisheries.

The most relevant INFISH (1995) standard to this the action alternatives is TM-1(b). To meet it the Forest would avoid actions in the RHCAs (all action alternatives). In alternative 4, the activities proposed would apply silvicultural practices to acquire desired vegetation characteristics (deciduous stand development) to attain Riparian Management Objectives (RMOs) and avoid adverse effects on native fish. Road management standards in INFISH would be met by the project's focus on avoiding adverse effects to native fish by:

- Addressing issues related to the road infrastructure..
- Regulating traffic during wet periods to minimize erosion and sediment delivery.
- Maintaining roads to avoid sediment delivery to streams, and
- Addressing passage at stream crossings for aquatic species.

Table 3.8- 1 summarizes the INFISH RMOs and the existing condition of the three major streams in the analysis area (third order watersheds). Although the action alternative may have very minor effects on temperature or large woody debris short term or in small areas, none of the alternatives would measurably slow the rate of recovery below the natural rate at the scale of the third order watershed (INFISH 1995, A-3).

Alternative 4 would require field review by the fisheries biologist after marking to ensure that the protection of wetlands and near-stream zones are met in units 70 - 75 (Montana DNRC 2006). Alternative 4 treats aspen stands that occur within or directly adjacent to RHCAs.

Determination of Effects to Aquatic Species Listed as Threatened (Bull Trout)

The preliminary determination for this project is that the action alternatives fit the category of "May Affect, not likely to adversely affect" bull trout or their critical habitat (Table 3.8- 8). Lost Horse Creek and the Bitterroot River are listed as critical habitat. Lost Horse Creek and South Fork Lost Horse Creek are the only streams that are known or suspected of supporting bull trout within the project area, and have low risk of being affected by the actions proposed. Low risk and the duration and intensity of the effect, if effects were to occur lead to this determination. The primary affect would be accumulation of fine sediment into Lost Horse Creek from road use and log haul. As previously discussed the risk for this to occur in Lost Horse subwatershed is low because of the limited number of crossings and the few areas where the road is close to the streams. Much of the activity would also occur on the upslope side of the Lost Horse Feeder Canal that would intercept fine sediments and waters with elevated temperatures if that were to occur.

Alternative 1, No Action, would have "no impact" on bull trout, bull trout critical habitat. Population viability is unlikely to change from the current depressed condition at both the local population scale, and elsewhere on the Bitterroot National Forest.

Determination for Sensitive Species (Westslope Cutthroat Trout and Western Pearlshell Mussel)

The Regional Forester designated westslope cutthroat trout and western pearlshell mussel Sensitive Species. The biological evaluation was incorporated into this fisheries report (FSM 2670.4) and the following paragraphs summarize the determination of effects on these two species (Table 3.8- 8).

Alternative 2 and the other action alternatives "may impact individuals or habitat [of Westslope Cutthroat Trout], but will not likely contribute to a trend towards federal listing or loss of viability to the population or species". The affects between the action alternatives do not differ enough to warrant separate determinations. Rationale for this determination is described in the "Direct and Indirect Effects" and "Cumulative Effects" sections, and is similar to the determination for bull trout. This determination is based on the potential for minor, negative short-term impacts to Lick Creek, and the lack of long-term negative effects. The risk and probability of effecting westslope cutthroat trout in Rock and Lost Horse Creek is less than the minor and relatively short-term effects that would be expected in Lick Creek. Population viability is unlikely to change from the current depressed condition at both the local population scale, and elsewhere on the Forest.

Western pearlshell mussels are likely absent from the project area. All the alternatives would have *No Impact* on this species. Western pearlshell mussels have not been observed in or near the project area. The fisheries biologist is familiar with the species and the habitat, has identified the species in another stream on the Forest, and has reviewed the affected streams in the project area.

Table 3.8- 8: Summary of Determinations for Aquatic Species Listed as Threatened Under Endangered Species Act, or as Sensitive by the Regional Forester Region 1, USDA Forest Service.

SPECIES	DETERMINATION	
	NO ACTION ALTERNATIVE	ALTERNATIVES 2, 3 AND 4
Bull Trout	No Effect	May Affect, Not Likely To Adversely Affect
Bull trout Critical Habitat	No Effect	May Affect, Not Likely To Adversely Affect
Westslope Cutthroat Trout	No Impact	May impact [1]
Western Pearlshell Mussel	No Impact	No Impact

[1]The complete official wording for the determination is: May impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species

3.8.4.7 Summary of Effects

Effects of the No Action Alternative on fish and aquatic habitat are negligible. No direct effects will occur, and the indirect and cumulative effects are likely to be very minor and are difficult to substantiate with confidence. Table 3.8-9 summarizes the effects, for each alternative, to the issues raised.

The harvest of trees in the action alternatives would have very minor direct effects on fish or aquatic habitat. There are no expected short-term adverse effects from the proposed non-commercial thinning or prescribed fire. The mid to long-term effects of the activities in the action alternatives would be likely to be slightly beneficial because of the reduced threat of uncharacteristic wildfire and the minor improvements proposed in the road network.

The road density and the number of road crossings of Lick Creek tributaries have created instream conditions that are unfavorable to native trout, primarily uncharacteristically high levels of fine sediment. The action alternatives would improve the condition by eliminating a small percentage of the problem sites. Alternative 2 includes constructing road above springs that flow toward Lick Creek, but the topography and design should limit the effects to a negligible level. Alternative 3 would be slightly more beneficial than Alternative 2 because no new roads or trails would be developed.

Alternative 4 is similar to Alternative 2, but would also cut and remove some conifers to stimulate deciduous vegetation in non-fish-bearing riparian areas. The risk to native fish and fish habitat is extremely minor and outweighed by the benefit of adding habitat diversity. These areas are often left untreated because of concerns for native fisheries and are under-represented on the landscape.

3.8.4.8 Summary of Effects of Each Alternative to the Issues Raised During Scoping

Table 3.8- 9 outlines the effects of the alternatives to the issues raised during scoping. The overall conclusion is that this project would have very little effect, positive or negative, on fish or aquatic habitats. There are small beneficial affects noted, and small risks of impacts. Beneficial effects that would be localized, but have the potential for long term effects include the treatments to restore deciduous vegetation in Alternative 4, the treatment of the borrow pit and the road that accesses it (in all action alternatives), and the potential future replacement partial barrier in Lick Creek at Rd 10051 (all action alternatives). There is very little risk of deleterious effects to fish and aquatic habitat that would reach the level of being measureable.

Table 3.8- 9: A Summary of the Effects of each Alternatives Potential Consequence for Each Issue. When there are two grades given the first is Effect on Current condition, and second is effect on risk of long term adverse change.

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
ISSUE: INCREASED STREAM TEMPERATURES AS A RESULT OF REDUCING NEAR STREAM SHADE.				
Changes in shade along streams with native fish habitat or along streams that contributes to those habitats.	Maintain	Maintain	Maintain	Maintain
Change to areas that have the *potential* to grow vegetation that could provide shade and cool streams with native trout habitat.	Maintain	Maintain	Maintain	Maintain
***ISSUE*: DECREASE IN HABITAT COMPLEXITY AS A RESULT OF REDUCING CURRENT OR FUTURE AMOUNTS OF LARGE WOOD NEAR STREAMS.**				
Retention of large trees along streams and the recruitment of potential large trees into streams	Maintain	Maintain	Maintain	Maintain /Degrade non fish bearing wet areas for the benefit of aspen.
Diversity of vegetation along streams and wetlands	Maintain /Degrade	Maintain /Degrade	Maintain /Degrade	Restore
***ISSUE*: BARRIERS IN STREAMS AFFECT THE NATURAL MOVEMENT AND LIFE HISTORY CHARACTERISTICS OF FISH AND OTHER AQUATIC SPECIES.**				
Stream length unaffected by man-made barriers.	Maintain	Minor improvement	Minor improvement	Minor improvement
***ISSUE*: ACCELERATED DEPOSITION OF SEDIMENT INTO STREAMS AND WETLANDS.**				
The size and proximity of existing roads to aquatic habitats including all streams and wetlands.	Maintain	Minor Improvement	Minor Improvement	Minor Improvement
The size and proximity of new roads relative to aquatic habitats.	Maintain	Maintain	Minor Improvement	Maintain
***ISSUE*: EFFECT TO NATIVE FISH POPULATION CHARACTERISTICS SUCH AS GROWTH AND SURVIVAL, DIVERSITY, GENETIC INTEGRITY, AND PREDATION AND COMPETITION.**				
Ability to recover from disturbances (i.e. fire and flood)	Maintain	Maintain/minor Improvement	Maintain/minor Improvement	Maintain/minor Improvement
Probability of hybridization or displacement by competitive species.	Maintain	Maintain	Maintain	Maintain